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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

LE, THAO P

ART UNIT PAPER NUMBER

2818

DATE MAILED: 05/15/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/653,149

Applicant(s)

DERDERIAN ET AL.

Examiner

Thao P Le

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 31 August 2000.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☐ Claim(s) 1-25 and 34-75 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) 1-25, 34-75 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 24, 25 6) ☐ Other: _____

DETAILED ACTION

Oath/Declaration

1. The oath/declaration filed on 07/11/01 is acceptable.

Information Disclosure Statement

2. This office acknowledges of the following items from the Applicant:

Information Disclosure Statements (IDSs) filed on **07/02/02, 10/22/02, 04/02/03** and made of record as Paper No. 24. The references cited on the PTOL 1449 form have been considered.

Specification

3. The specification is objected to for the following reason: The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed (see MPEP § 606.01).

The specification has been checked to the extent necessary to determine the presence of all possible minor errors. However, the applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. **Claims 1-9, 11, 13-14, 16-41, 43-47 are rejected under 35 USC 102 (e) as being anticipated by Raaijmakers et al.(will be referred as Ra), U.S. Patent Application Publication No. 20010024387.**

Regarding to claims 1 and 34, Ra et al. discloses the method of forming a capacitor fabrication similar to what recited in claim 1. See Figs. 2-4B and depending specification. Ra discloses the method of forming the capacitor comprising the steps of forming a first electrode 300 (Fig. 8) over a substrate, atomic layer depositing a conductive barrier layer 304 or monolayer which originally contain HSG (Fig. 2, and steps 101, 102, 104 in Fig. 4A, Fig. 4B, or abstract), forming a capacitor dielectric layer 302 and a second electrode (Figs. 8-10).

Regarding to claims 13 and 47, Ra et al. discloses the method of forming a capacitor comprising a first electrode, chemisorbing a layer of a first precursor at least one monolayer thick over the first electrode, chemisorbing a layer of a second precursor

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at least one monolayer thick on the first precursor layer (Fig. 4B), forming a dielectric layer over the first electrode and forming a second electrode over the dielectric layer.

Regarding to claims 2-3, Ra et al. discloses the atomic layer depositing step occurs at a temperature, pressure, and thickness of the atomic layer within the range that recited in claims 2-3, about 200 to 500 oC and about 5 Torr (Page 10) and the thickness is between about 20 to 100 Angstrom.

Regarding to claims 4, 35, Ra et al. discloses that the atomic layer contacts the first electrode or forms over the first electrode whereas the first electrode contains HSG which is then exposed to chemistries to form monolayers (abstract).

Regarding to claims 5, 36-37, Ra et al. discloses that the atomic layer comprises WN, TiN and similar (metal or metal alloy) (pages 13-14).

Regarding to claim 6, Ra et al. discloses that the dielectric layer is tantalum pentoxide. It would have been inherent that tantalum pentoxide has K factor greater than 7 at 20oC (page 14).

Regarding to claims 7-8,38-39, Ra et al. discloses that the second electrode comprise polysilicon and the dielectric layer is tantalum pentoxide which comprises oxygen.

Regarding to claim 9, Ra et al. discloses the dielectric layer is over the barrier layer.

Regarding to claim 11, Ra et al. discloses the forming the electrodes and the dielectric layer occur by other than atomic layer deposition.

Regarding to claims 14, 16-17, 41, Ra et al. discloses that the first and second precursor layers each consist essentially of a monolayer or of one chemical species and the first and second precursor are different from each other.

Regarding to claim 18, Ra et al. discloses that the first and second precursors comprises TaCl₃, N₂ and water and form a monolayer of tantalum oxide.

Regarding to claims 19-20, 43, Ra et al. discloses that the chemisorbing is performed before forming the dielectric layer and the atomic barrier layer is capable of prevent oxygen diffusion to the first electrode.

Regarding to claim 21, Ra et al. discloses the atomic layer has the thickness within the range that recited in claims 21 which is between about 20 to 100 Angstrom.

Regarding to claims 22, 44-45, Ra et al. discloses that the atomic layer comprises WN, TiN and similar (pages 13-14).

Regarding to claim 23, Ra et al. discloses that the dielectric layer is tantalum pentoxide. It would have been inherent that tantalum pentoxide has K factor greater than 7 at 20oC (page 14).

Regarding to claims 24-25, 46-47, Ra et al. discloses that the second electrode comprise polysilicon and the dielectric layer is tantalum pentoxide which comprises oxygen.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 10, 12, 15, 42, 48-75 are rejected under 35 U.S.C. 103(a) as being unpatentable over Raaijmakers (referred as Ra) et al., U.S. Patent Application Publication No. 20010024387.

Regarding to claim 10, Ra doesn't disclose the formation of another conductive barrier layer over the dielectric layer, it would have been obvious in the art to form another atomic layer above the dielectric layer and below the second electrode in order to prevent oxygen diffusion from the second electrode to the dielectric layer.

Regarding to claim 12, Ra doesn't disclose the use of HF dip, HF vapor clean, or plasma to clean first electrode prior to the formation of the atomic layer. it would have been well known in the art that cleaning the first electrode prior to the atomic layer depositing by HF dip, HF vapor clean, or plasma in order to avoid contamination.

Regarding to claim 15, it would have been obvious in the art that those chemicals used to form monolayers would have been considered as saturated monolayers.

Regarding to claim 42, Ra et al. discloses the first and second precursors comprise TaCl₅ and a compound that contains nitrogen. It would have been inherent in art that NH₃ that contains nitrogen can be used.

Regarding to claims 48-75, it would have been well known in the art that TiN is widely used as barrier layer, and Ra discloses the use of Al₂O₃ to form capacitor dielectric.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thao P. Le whose telephone number is 703-605-1187. The examiner can normally be reached on Monday-Thursday 7:30am-6: 30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms can be reached on 703-308-4910. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

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Thao Phuong Le

Examiner



HOAI HO
PRIMARY EXAMINER